China's Digital Destroyers: Striving for Information Dominance

By Cindy Hurst

Introduction

In 1996, a Chinese academic military paper pointed out that the new military revolution is bound to have a crucial impact on naval warfare and the naval establishment. The article argued that information supremacy is the key to winning future naval warfare.[1]

Chinese government and military leaders, as well as scholars, have continued to encourage such a transition to a more informatized military. For example, Chinese Premier Wen Jiabao stated that "We must actively promote the revolution in military affairs with Chinese characteristics and make efforts to achieve development by leaps and bounds in national defense and armed forces modernization." He went on to say that modernization of the armed forces must be "dominated by informatization and based on mechanization."[2] According to China's 2008 national defense white paper, informatization is the "strategic priority" of the country's Navy modernization drive.[3]

While some critics perceive the modernization of China's Navy as a threat, its modernization is viewed by the Chinese publicly as a defensive measure. The country has been growing at an average rate of eight percent annually over the past two decades. To support this growth, China needs raw and other materials, including oil and natural gas, metals, plastics, organic chemicals, electrical and other machinery, and optical and medical equipment. These resources are transported via ship from countries all over the

world. Due to piracy and instability in various regions of the world, without proper security, the safety of these shipments could be at risk.

China has also been feeling the pressure from neighboring countries and regions, many of which have been competing to build up their own oceangoing strategies and forces. There are regional naval powers distributed in key geopolitical regions surrounding China and throughout key maritime routes. To the north lies Russia's Pacific Fleet. To the east lies the Japanese Navy, which is the dominant branch of the country's armed forces.[4] China also cannot discount the strength of the Taiwanese Navy. On the other side of the Strait of Malacca is the Indian Navy, which is the fifth largest maritime force in the world.[5] Finally, there is the ever-present United States Navy, which has a forward deployed presence in the region through its Seventh Fleet.

China's naval buildup can also be viewed as a way to help coerce Taiwan into accepting a one-China solution to the cross-strait dispute or, at a minimum, to prevent Taiwan from pressing forward with independence one day. Finally, China's naval buildup can simply be seen as an attempt to expand the country's influence and power well beyond its borders.[6]

No matter what the reasons behind China's modernization, one thing is apparent: China is making strides toward modernizing its Navy. This paper will focus on China's push to informatize its Navy and thus to be able to better defend its territory and resources -- and extend its global power.

From Mechanization to Informatization

In developed nations, the trend of maritime operations over the past century has changed from employing two dimensional, mechanized systems to three dimensional, informatized systems. For example, during World War I, firepower played the leading role in maritime operations, which consisted primarily of surface vessels. During this era, powerful navies consisted of giant vessels and big guns, and opponents would fight one another with these vessels and guns in a linear operation. During World War II, the strategy of maritime battles developed and the leading elements consisted of fire power and maneuvers. Aircraft carriers, submarines and naval air forces added a new dimension and made rapid troop maneuvers on the maritime battlefield possible.

Today, the most modern navies have adopted an information-system-based maritime system of systems operation. In such a system, information has taken the place of mechanization as the primary platform and today is the key player in maritime operations. Information systems guide the efforts in maritime reconnaissance and monitoring, maritime command and control, maritime combat actions, maritime combat support and so on. Additionally, information warfare has become an important form of operation, while psychological operations and deception now have digital/information-related components.

China is no exception to this trend. Despite China's military capability having lagged behind that of the United States, due to its past lack of domestic technological innovation, it has been making great strides in its modernization efforts. Today, it too has placed information operations at the forefront of all its naval operations strategic developments.

Since its founding over six decades ago, the People's Liberation Army Navy (PLAN) has continually been evolving and building up its capabilities. Between 1949 and 1955, China set up its surface ship force, coastal defense force, aviation, submarine force, and Marine Corps. The country also began working on building a light maritime combat force. From 1955 to 1960, China established the East Sea Fleet (*Donghai*), South Sea Fleet (*Nanhai*) and North Sea Fleet (*Beihai*). From the 1950s to the 1970s, China conducted local defensive operations. Since the 1980s, the PLAN has been transforming strategically to an offshore defensive operation.[7]

By the mid-1990s, Chinese military scholars began to realize that information warfare would become the central technology of global military powers in the 21st century. In 1995, Major General Wang Pufeng, a former Director and researcher at China's Institute of Military Science, pointed out that China's strength, equipment, strategy, tactics, and military theory were products of the industrial era and were far from being capable of meeting the demands of information warfare.[8] He went on to explain that "information warfare theory is a new warfare theory." He recognized the fact that China lagged behind in information technology and information weapons, and he urged the country to further study information warfare to one day be able to achieve information superiority.[9]

In 1996, Navy military scholars and officers Shen Zhongchang, Zhang Haiying, and Zhou Xinsheng wrote an article that discussed the "new military revolution." In their article they wrote, "Electronic and information technology will have the most far-reaching significance. As they raise the capability to collect, process, and transmit battlefield information, making the battlefield more transparent, command more in real

time, and fire strikes more accurate and reliable, they speed up the course of naval warfare. So undoubtedly, in the course of this military revolution, combat theory and concepts are undergoing profound change."[10]

The new millennium saw further progress in China's pursuit of "informatizing" the Navy, especially as China hoped to be able to meet the challenges of adversarial navies in future conflict. PLAN Rear Admiral Zhang Zhaozhong, director of the National Defense University Military Logistics and Equipment Department, once said that the greatest lesson learned from the Iraq War was the importance of information warfare. According to Zhang, information warfare should not be conducted only in the sphere of computer networks, but it should also proceed in coordination with traditional mechanized modes of war.[11]

In 2003, Dai Qingmin, a major general and former director of the General Staff Department's Fourth Department (for electronic warfare), pointed out that the concept of information supremacy had emerged to join the concepts of sea supremacy and air supremacy. Dai went on to explain that, in "high-tech warfare," without information supremacy there can be no sea or air supremacy.[12]

Transitioning to Joint Operations

While information operations has become a common theme for the PLAN, another common theme in Chinese analysis of modern warfare is the importance of joint operations. Experts within China believe that a successful operation can no longer be conducted by just the army or the navy or the air force alone, but rather by a combination

of all forces, plus space forces.[13] These forces have complementary functions that can join together in an organic system, relying on networked information systems.

The Gulf War and Kosovo War have had a huge impact on the ongoing shaping of Chinese military strategy. Chinese military thinkers have studied every aspect of these wars in an effort to incorporate the strategies into their own military operations, using Chinese characteristics. These wars are noted as two typical examples of joint operations that had trans-epochal significance. Since observing these wars, China has been moving toward a joint operation environment. According to Major General He Lei, Chief of the Academy of Military Science's Department of Operation Theories and Doctrine Studies, "It is difficult for any single military service to dominate the battlefield. Victory in war can be won only so long as the forces of all services and arms form a joint operations system."[14] Major General He pointed out that during the Gulf War, U.S.-led coalition forces first gained electromagnetic battlefield supremacy with powerful electronic warfare and carried out 38 days of sustained air attacks against Iraq. Next, they launched a ground offensive. During the Kosovo War, U.S.–led NATO forces used both sea and air forces to carry out 78 days of massive air raids against the Federal Republic of Yugoslavia, forcing it to agree to a ceasefire.[15]

According to Major General He, during joint operations under informatized conditions, the battlefield has expanded from the traditional land, sea, and air into the areas of space, networks, and the electromagnetic environment. This creates an integrated, multidimensional battlefield space with complementary coordination, dependence, and synergy. "All operational areas seep into each other; they cannot be separated. Isolated battlefields no longer exist," he explained. [16]

Joint operations under informatized conditions allow military commanders to understand both enemy and friendly battlefield situations and how they are changing in real time. It also provides precise target data. According to the 2010 Chinese national defense white paper, "The PLA takes the building of joint operation systems as the focal point of its modernization and preparations for military struggle, and strives to enhance its fighting capabilities based on information systems."[17]

In order to be effective in modern warfare, China has been striving toward developing the capability to conduct integrated joint operations, such as sea and air operations. The PLAN is aware of the limitations of its tactical air support at sea when away from home waters, and therefore it needs to rely heavily on the integrated joint operations concept for blue water deployments, a current pursuit of the PLAN.[18]

In 2004, Ye Xinrong and Zuo Xueshu, both from the Chinese Naval Research Institute of the PLAN, wrote about the importance of China moving toward a blue water Navy to safeguard its strategic ocean interests and ensure maritime safety. They asserted that this new buildup has to adopt new strategic theories. With rumors and press pointing to its pursuit of incorporating aircraft carriers into its fleet, the possibility of China becoming a full-fledged blue water Navy is no longer unrealistic.

Joint operations have already been shown to strengthen China's military capabilities. For example, in November 2002 a Chinese report stated that an (unidentified) artillery brigade, under the command of (Zho) Zengming, commander artillery brigade under 24th Group Army located in Changde, Hebei, developed a field reconnaissance system that integrated the PLA Air Force and PLAN's functions of direction finding and positioning, battlefield television, microwave transmission, laser

range finding, and command in movement, which increased the brigade's observation range by three to five times. [19]

China's Growing Informatized Capabilities

In 1990, Chinese thinkers had concluded that it would take time for information to truly dominate the battlefield and that the battlefield of the 21st century would be made up of a combination of informatization and mechanization. They predicted that, among other things, noncontact operations and over-the-horizon strikes would be commonly used; and the responsibilities of the different armed forces would converge (joint operations).[20] The Gulf War changed that thought process.

Fast forward to the new millennium. In 2000, the PLAN had approximately 60 destroyers and frigates in its inventory.[21] Today, according to Jane's, there are approximately 80 destroyers and frigates.[22] China has been slowly replacing its older surface combatants with newer destroyers and frigates. China modernized its fleet of first generation destroyers by retrofitting them with new technologies to improve their combat systems. Improvements were mostly in the ships' electronics and combat-intelligence command systems.

In 2003, China launched a home-grown "Aegis" destroyer in Shanghai. The destroyer is said to be equipped with an advanced radar system, stealth design, a vertical launch system, and long-range antiaircraft missiles.[23] Type 052B guided missile destroyers integrate over-the-horizon sea-attack capabilities, maritime formation operations command capabilities and area air defense operations capabilities into one.[24]

More recently, according to video images of various naval exercises conducted by the South Sea Fleet, China has been adapting and keeping pace with equipment change/replacement. In these exercises, a Type 052C destroyer served as the flagship. These exercises were reportedly joint operations that were intended to test the application of a data link system fitted on the navy battleships. Most of the surface battleships of the South Sea Fleet are equipped with a tactical data link system (possibly called CLINK11 by KDR {HN900}), which could upgrade the capability of the fleet and guarantee that the PLAN's underwater systems can extend forward and launch attacks against an opponent under the command of the data link. The exercises have also tested the performance of the integrated information warfare systems and the sensor systems fitted on the Type 052B/C destroyers. These ships are equipped with new generation shipboard weapons systems and electronic equipment and are critical to the PLAN's overall maritime network warfare strategy. The radar and weapon control consoles employ sensor control system network monitors. The most important shipboard system is a large phased array radar and guided missile vertical launch system, which is similar to the SPY-1D phased array radar and MK41 guided missile vertical launch systems on U.S. vessels. Not only do they support a dual redundancy 100Mbps network, but they can also display the combat data at different levels through multiple channels.[25] These shipboard systems and equipment have been called the "Holy Shields of China."[26] All new PLAN DDGs and FFGs are now being fitted with the Russian Mineral ME radar, which has a data link that can detect and track multiple weapons targets passively at distances up to 155 miles or actively up to 280 miles.[27] By 2007, the PLAN began establishing a multidimensional integrated campaign/tactical command system (JRCO C4ISR). [28]

Another ship undergoing informatization is the Yuanwang class ship. China has

six of these ships, used to track satellite and missile launches. China has been

manufacturing the Yuanwang since 1968. The first two Yuanwang ships appear to have

started operations around 1980, in connection with the DF-5 missile test on 18 May 1980.

These ships have traveled to various regions, such as the Sea of Japan, the West Pacific,

the South Pacific, the Indian Ocean, and the South Atlantic, to carry out their tasks. They

are meant to compensate for inadequate land tracking stations.[29]

There have been some suggestions that the Yuanwang class ship could be used for

more than space tracking. One report put out by Taiwan suggested that there should be

concern about the fact that commercial satellites normally transmit signals that are not

encrypted. Therefore, "if a receiving station is within the area of signal bleed-over range,

it can receive ambiguous images. As a result, the actual area that has been spied upon by

satellite may be determined from analyzing such ambiguous images."[30] In other words,

China can receive random images and, through analysis, can determine their origins,

which could provide valuable intelligence. Both China's Xiang Yang Hong class

oceanographic research ships and Yuanwang class space tracking ships are often seen

near Taiwan. Some experts fear that these ships could be used to intercept satellite remote

sensing signals.[31] According to Richard Fisher, author of *China's Military*

Modernization, space event ships could potentially be armed with lasers to track/dazzle

satellites.[32]

In 2010, China was reported to be building a line of 20,000-ton-class dock-

landing ships (Model 071) that can carry landing hovercraft and provide over the horizon

targeting. Experts project that over the next decade the PRC will be building Model 081 landing ships, which will be close in size to the Model 08 landing ship.[33]

These are just some examples of the progress observed in the informatization and improved mechanization of the PLAN's fleet. China is also said to be developing systems to attack adversarial systems to paralyze them.

One Step Forward - Attack

Perhaps the best contribution the Chinese Navy can make to the country's information dominance is through countermeasures to paralyze adversary information systems. For example, according to Fisher, several sources disclosed and confirmed to him the PLA's ambition to deploy a new nonnuclear electromagnetic pulse (EMP) warhead on a short-range ballistic missile. Fisher wrote that the PLA is developing a family of radio frequency (RF) weapons as key future weapons for information warfare. Such weapons seek to use a form of "radiation to degrade or destroy microcircuits, computers, radar, and other sensors, communications networks, and other electronic systems."[34] According to Chinese military analyst Ye Jian, such bombs create a strong magnetic field and EMP that can paralyze radar and telecommunication systems of an aircraft carrier and nearby vessels, ship-mounted missiles, and aircraft located within dozens of kilometers of the point of detonation.[35] China has taken steps forward in the direction of developing RF weapons. According to some analysts, China will have RF weapons by 2015.[36]

In addition, the PLAN South Sea Fleet has the demonstrated capability to conduct electronic countermeasures. In October 2010, a regiment of the PLAN South Sea Fleet

showed off its electronic countermeasures capability by demonstrating an "invisible killer" on the electromagnetic battlefield during an area-wide joint tactical exercise. Using an integrated command and control platform, the regiment successfully eliminated strong jamming signals which prevented their aviation arm from being able to lock on to select targets. Then, through aerial intelligence and synchronized data transmitted by surface vessels, they were able to lock on to targets and guide the aviation arm to destroy them.[37]

In 2004, Liu Huanyu, a researcher at the Dalian Naval Academy, proposed a sea-based platform to counter enemy satellites. According to an abstract of the article, "The development of military space systems has enlarged the gap in sea power and posed a direct threat to sea power in the 21st century. In order for a country to intervene on the ocean, its sea power must be able to effectively suppress the function of the military space system."[38] In his article, Liu gave a description of U.S. military satellite systems. He then went on to outline requirements for sea-based antisatellite platforms. He wrote that these platforms should have the ability to carry out sustained interference and attack, survive, and have great mobility and longevity. He pointed out that antisatellite nuclear submarines would be ideal because of their ability to be well concealed and to sail for long periods of time. Antisatellite cruisers have a primary advantage of having strong autonomous searching capability because they can be equipped with spatial detection radar, as well as large scale electro-optical detection systems. Liu concluded that "The sea-based anti-satellite platform is a major component of the new sea power and must be given a high priority. If this new avenue is explored as soon as possible, China can hopefully improve its sea-power dramatically within ten years."[39]

China could also potentially possess information warfare potential through its deep-sea research submersibles. China's first manned submersible, the "Jiaolong," is being touted as a breakthrough in technology. According to information published by the China Ocean Institute, the Jiaolong is capable of "taking samples of sediment and plankton at fixed points, sampling mineral cores, measuring seawater temperature, drawing high precision topography maps, still and video photography of sunken ships and maintenance and inspection of deep sea pipelines and electrical cables."[40] However, some China analysts and skeptics believe that the submersibles might one day be used for military purposes, such as cutting or bugging underwater communication cables.[41] Among its many technological capabilities, the Jiaolong can hover over a fixed position while the pilot uses a mechanical arm to perform certain operations.[42]

In some cases it is difficult to determine the extent of China's current attack capabilities. For example, in a study prepared for the U.S.-China Economic and Security Review Commission, the author concludes that "there may be covert activity in the development of space weaponry and space warfare plans which is not represented in open source literature."[43] The author drew this conclusion directly from three books written by Chinese Colonels Li Daguang, Jia Junming and Yuan Zelu, all who advocated covert deployment of a sophisticated antisatellite weapon system to be used against the United States in a surprise manner without warning.[44]

Proof of Progress is in the Training and Education

As the PLAN continues to modernize its systems and networks, it increases the need for more technical training and more highly educated personnel to maintain and

control it. Therefore, the level of education and technical training in the Chinese Navy has been increasing. Over the past ten years, the PLAN has realized a significant increase in higher educated navy commanders. In 2001, only one navy captain had a doctorate. By 2011, more than 100 captains have either a master's or doctor's degree. Furthermore, in the past five years more than 20,000 university graduates enlisted in the Navy.[45]

Former Chinese president Jiang Zemin reportedly emphasized the importance of pursuing training for a new-type of military personnel. One of the primary objectives is to leap from current requirements to future requirements (based on forward looking visions). In other words, prior to the new millennium Chinese military thinkers had already understood that, in order to achieve informatization, personnel would have to be trained in that area to accelerate the transition from a mechanized system to a more informatized one.

During the first part of the new millennium, the Naval Command College successively sent ten investigation and study groups to various PLAN fleets and PLAN Air Force units to discuss with resident commanders the central issues affecting joint operations. The investigations showed that the college graduates were not able to completely adapt themselves to the global military reform. As a result, a number of experienced teachers from the College took steps to reform the training methods. The College ended up integrating Chinese naval strategic theories with foreign, primarily Western, ones in the area of the theory of naval strategy. They incorporated specific teaching programs of Western naval colleges and offered special training subjects on foreign military campaign theories, command of campaigns and operations, and naval information warfare.[46]

Since 2001, the curriculum at the Navy Command Academy has been tailored to teach the staff and cadets about military joint operations. To adapt to the model of future joint operations, the academy set up training courses in key areas such as naval information warfare and naval operations and "training under a complex electromagnetic environment." It has also added a course on "command of naval information operations" to its graduate curriculum.[47]

During a 2004 seminar held by the Electronic Engineering Academy, Qian Junsheng, a brigade commander in the Second Artillery Corps, urged all levels of commanders to foster a strong awareness of and ways to gain information dominance, intensify IT-based military construction and IT-oriented operational training, and work hard to gain the ability to engage in information warfare. During that same seminar, Jiang Yong, a commander of a destroyer squad, said that in future high-tech naval battles, commanders should be able to command the defense against threats from multidimensional space. To do this, he said commanders need to have a good command of sea warfare tactics and also to gain specialized technical knowledge on electronic, networked, and information warfare.[48]

During the summer of 2006, the PLAN conducted a large-scale informatized joint drill. This drill encompassed China's maritime emergency response operations and operations under complex electromagnetic conditions.[49]

According to China's 2010 national defense white paper, "The complement of new-mode and high-caliber military personnel who can meet the needs of informatization has been steadily enlarged." Because of its new large warships, submarines and aircraft being put into service, "the Navy has been intensifying the training of professionals who

are supposed to fill the key posts," said Xia Ping, a senior captain and director of the personnel department under the Political Department of the PLAN.[50]

Chinese troops have been training in complex electromagnetic environments. Exercises frequently begin with enemy electronic jamming and cyber attacks on friendly units.[51] Between 2000 and 2009, according to one report, the PLA has conducted approximately 16 drills having "joint" or "joint command" characteristics.[52]

Today, the Academy of Military Sciences is China's main research center for "informatized warfare."[53] However, China has at least eight naval educational institutions: Naval Command College; Naval Engineering University Wuhan City, Hubei Province; Naval Aeronautical Engineering College in Yantai City, Shandong Province; Dalian Naval Academy in Zhongshan District; Dalian, Naval Submarine College (Navy Submarine Academy), in Qingdao, Shandong Province; Naval Arms Command College (Sea-Arms Command College) in Guangzhou City, Guangdong, Province; Naval Flying College (Naval Aeronautical Engineering Institute) in Yantai City, Shandong Province; and Bengbu Naval School for Noncommissioned officers. Most, of these institutions have a heavy emphasis on information warfare and information operations in their curriculum. At least half of them conduct applied and basic research of various information warfare and information operations applications.[54]

Conclusion

According to the Department of Defense 2008 Annual Report to Congress on the Military Power of the People's Republic of China, China "has the greatest potential to compete militarily with the United States and field disruptive military technologies that could over time offset traditional U.S. military advantages."[55] China has been taking

many steps to modernize its navy, with information operations and systems of system operations serving as the glue for a joint operations structure. China's goal is to develop a force equipped with the skills and weapons systems to win, at the very least, a local war under informatized conditions.

China has long been known for its reverse engineering of competitor's weapons and military systems. Over the past two decades though, China has recognized that it will never get ahead by simply copying technology. In an ever-evolving world of technological innovation, by the time China catches up, developed countries have already moved on to the next level. According to Dai in 2003, China "cannot copy the developmental pattern of the developed Western countries." Rather than mimicking the developing patterns of the developed Western countries, Dai suggested that China leap over the advanced stage of mechanized warfare development as quickly as possible and follow a compound-type path of development influenced by the country's own characteristics.[56]

Whether or not the PLAN will one day successfully meet all its goals of achieving superiority through informatization, mechanization, and a fleet of fully capable sailors who can operate these systems remains to be seen. In the meantime, however, it appears that China's propellers are in motion as the country pushes forward with its modernization efforts.

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